Mesoscale Priority Research Direction

Integrating mesoporosity into nanoporous materials

Opportunity

The high surface area of nanomaterials is the key to efficient use of materials that is crucial for many future energy and catalysis related technologies. Integration of nanomaterials into mesoporous architectures will allow one to combine the benefits of the high surface area of nanomaterials with the efficient mass transport in mesoscale achitectures.

Approach

A predictive mesoscale modeling capability needs to be developed to design complex 3D nano-meso architectures that are optimized for fast mass transport. Advanced characterization techniques such as synchrotron-based ultra-high resolution CT need to be developed to provide the necessary feedback for materials synthesis.

Meso Challenge

The challenge to solve is how to integrate nanomaterials into mesoporous architectures. Can robust synthesis approaches be developed based on templating and self-organization? How can mesoscale simulations and advanced characterization be used to optimize nano-meso architectures?

Impact

The development of nanomaterials with integrated mesoporosity will improve the power density, efficiency and throughput of next generation energy storage and conversion materials, and thus has game changing potential.

References: Biener, J.; Stadermann, M.; Suss, M.; Worsley, M. A.; Biener, M. M.; Rose, K. A.; Baumann, T. F., Advanced carbon aerogels for energy applications. *Energy & Environmental Science 2011, 4, 656–667.*

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